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The Official Organ of The American Oil Chemists' Society

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EDITORIAL

OUR 1926 CONVENTION

The time for the annual meeting of the American Oil Chemists' Society is close at hand. We will gather together at the Roosevelt Hotel on May 10 and 11. It is unnecessary to urge those of us who have attended previous conventions and have enjoyed the spirit of fellowship and co-operation which always exists, to make every effort to attend. As soon as the days begin to lengthen, and the feeling of spring is in the air, we begin to think and write about the annual meeting, and to look forward to the renewal of its associations which have made this an event worth while. Only illness or the most important business reasons will prevent the attendance of most of those who have been present on former occasions.

If you have never attended one of our meetings plan to come to New Orleans this year. The meeting is open to all chemists, or men interested in technical subjects, whether they are members of the society or not. New Orleans early in May is a delightful place. The weather conditions are usually ideal, and its location and history make it one of the quaintest cities of our country. There are many places of interest for the visitors, and the delightful cuisine of its various restaurants is known throughout the world.

The American Oil Chemists' Society has been an important factor in standardizing and improving methods for the analysis of cottonseed products, and of late years has broadened its scope to cover the analytical work of allied fats and oils. The papers at the convention will consist in a large part of reports on methods, and co-operative work connected with them, and papers by men on subjects of special interest. It is here that we talk over our mutual difficulties and successes, and form the friendships which are so helpful in our everyday life.

Let us decide now that if it is at all possible we will be at New Orleans on the tenth of May.—J. J. V.

THE A. O. C. S. CONVENTION

The convention of the American Oil Chemists' Society will be held at the Hotel Roosevelt, New Orleans, May 10 and 11. This meeting precedes the thirtieth convention of the Interstate Cotton-seed Crushers' Association, which organization meets at the same place the day following, May 12, and remains in session until May 14.

The program will consist in large part of the reports of the various committees, which have been doing co-operative work on the methods of the society. Changes will be thoroughly discussed, and if approved by the convention, on report of the Uniform Methods Committee will be referred to the proper authorities for approval. A number of special papers have been arranged on the program, and among the speakers are the following: The Honorable Christie Benet, General Counsel of the Interstate Cotton-seed Crushers' Association; G. S. Meloy, U. S. Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C.; Dr. G. S. Jamieson, Fat & Wax Laboratory, Bureau of Chemistry, United States Department of Agriculture, Washington, D. C.; Dr. David Wesson, Southern Cotton Oil Company, N. Y.; H. J. Morrison, The Proctor & Gamble Company, Ivorydale, Ohio; and Dr. Francis Turner, Shriver & Company, Harrison, N. J.

These papers will be of great interest, as the speakers are all men of prominence in their own particular fields which they will cover.

This important function will be, as usual, a special feature of the Convention, and is a fitting finale to the meeting. The banquet will be held Tuesday evening, May 11, the hour and place to be announced later. Tickets must be secured on arrival, at time of registration.

Arrangements have been made for those attending the convention to secure round trip transportation at fare and a half on the Special Certificate plan. These certificates should be secured when purchasing transportation at the point of departure. They must be validated at New Orleans in order to obtain the reduction on the return trip.

Members who have attended former conventions know and appreciate to the full the stimulus of these meetings. Added to the mental refreshment and the joys of social intercourse is the beauty of the surroundings. It would be difficult to find a happier location for such an occasion than New Orleans, and the city is unusually delightful in the early days of May.

Associate members of the society are earnestly invited to attend, and they will find a very cordial reception awaiting them from the entire membership. A special part of the program has been reserved for all associate members who attend at which they may present any new process, apparatus material or machine.

Headquarters are at the Roosevelt Hotel (formerly the Grunewald).

THE TULSA MEETING OF THE AMERICAN CHEMICAL SOCIETY

This was one of the most enjoyable meetings ever held by the Society. Attendance is estimated between five hundred and a thousand; not too many to make the sessions crowded but plenty to make them interesting. Charles K. Francis, Chairman of the Oklahoma Section, with his many assistants, made the meeting one long to be remembered by those present. Oklahoma is the capital city of the Petroleum Oil Industry, and the general symposium on lubrication was very fully attended by those particularly interested in this subject.

It is not generally known that Oklahoma is the second largest cotton producing state in the country. The symposium on cotton and its products and vegetable oils was therefore, quite appropriate to the occasion. The number of papers and attendance at the cotton symposium were not as large by any means as at the petroleum division; but nevertheless some very interesting papers and facts were brought out.

Instead of the usual banquet the visitors were entertained by a combination evening of bridge, dancing and fashion show, which everyone enjoyed immensely. On Wednesday evening there was a very entertaining smoker, followed with unusually elaborate refreshments. Everybody left Tulsa impressed with the whole-hearted hospitality of its inhabitants and of entertainment committees in particular.

1. C. J. Esselen, Jr., read a very interesting paper on the "Importance of Cotton Cellulose as a Chemical Raw Material. He described the manufacturing of cotton linters as a preparatory step in cotton oil manufacture and then went into its various uses such as smokeless powders, rayon, artificial leather, automobile lacquers, celluloid and—what a few people would suspect—food adulteration. He did not state, however, just how it was used in this important industry.

2. John Malowan, New Orleans, read a very timely paper on the "Deterioration of Cottonseed by Moisture." He indicated the great losses occurring from this cause, and also various measures which are taken to combat them. The past season, with the abundant rainfall at the time when the cotton should be gathered, gives a terrible example of what may happen to the crop under these climatic conditions.

3. E. W. Schwartze read a paper on "Gossypol and Cottonseed Meal Poisoning." Mr. Schwartze brought out that great variations in the amount of gossypol was to be found in the seed from various localities. He related experiments showing the toxicity of the poisonous principles of the seed which were extracted directly from the kernels. The toxicity was determined by feeding small animals with known amounts of the toxic material. Dr. Fraps, of the Texas Experiment Station, in the course of

the discussion over the paper, took issue with Dr. Schwartze by calling attention to the fact that Dr. Schwartze's experiments were made with the kernels instead of with the cottonseed meal. He then related numerous instances where cottonseed meal was fed to various kinds of farm animals, which was done with safety providing the proper amount of forage crops was fed at the same time. The paper was also discussed by Dr. J. S. Hughes who stated there was no difficulty in producing the same symptoms in cattle which were fed on corn meal and dried out fodder, as was sometimes observed by feeding cottonseed meal under similar conditions.

4. Dr. E. F. Kohman gave a very interesting paper on the "Non-Oxidizability of Vitamin A in Foods," which showed that with proper preparation foods should not lose any of this valuable constituent by proper methods of cooking.

5. Dr. A. H. Richardson read a paper on the "Hydrogeneration of Cottonseed Oil with Platinum." It was one of a series of similar papers published in *Industrial and Engineering Chemistry*. It possessed a great interest for those present who are interested in this subject.

6. Dr. Louis C. Whiton's paper on "Practical versus the Theoretical Side of Oil Extraction" gave an account of modern European practice, which will be published later in full.

7. Dr. J. S. McHargue from the Kentucky Experiment Station read a very interesting and carefully prepared paper on "The Mineral Constituents of the Cotton Plant." He particularly stressed the presence of copper in various parts of the plant, even though the plants were raised in quite different localities.

8. Dr. R. S. Curtis, of the Raleigh (N. C.) Agricultural Experiment Station, gave a very interesting paper on the "Effect of Cottonseed Meal in the Dairy Ration," and showed as a result of his experiments that cottonseed meal could be fed in very large amounts with a ration containing proper mineral constituents combined with plenty of green fodder such as alfalfa, timothy and silage.

9. Dr. G. E. Holm, G. R. Greenbank and E. F. Deysher gave a very interesting paper on the "Susceptibility of Fats to Autoxidation." They described the apparatus in use in the Dairy Division of the Department of Agriculture at Washington. Fat is exposed under standard conditions in an atmosphere of oxygen at a definite temperature. The apparatus is connected up in such a manner that when the oxygen commences to be rapidly absorbed by the fat a partial vacuum is formed and the change of pressure is recorded on an instrument such as is used for similar purposes in the Weather Bureau. Observations given in the paper show the effect of different treatments on the susceptibility of oils. Very remarkable effects were shown by exposing oils to ultra violet light,

which caused them to absorb oxygen very rapidly. Fats kept in a perfect vacuum remain sweet for very long periods when very slight traces of moisture are present; on the other hand, when absolutely dry they show a tendency to oxidize much more rapidly.

10. Dr. Jos. F. Geisler, of the Experimental Exchange Laboratory, New York City, reported on the "Effect of Cottonseed Feeding on Butter Fat," and compared the results with those obtained with other feeds. He showed as a result of his studies that it was possible for the dairyman to buy varying feed to produce hard or soft butters at will and that any contentions to the effect that hard butters were adulterations were quite ridiculous.

11. Dr. G. S. Fraps, of the Texas Experimental Station, read a paper on the "Feeding Value of Cottonseed Meal." He gave results obtained by using meal for feeding all kinds of farm animals. Attention was called to its use as a chicken feed in comparison with tankage. The evidence seemed to show that it was fully as safe a feed as tankage, providing sufficient mineral matter such as salt or carbon seed was fed along with it. Dr. Fraps considered cottonseed meal one of the best concentrated cattle foods obtainable at the present time. He also called particular attention to the fact that in most of the experiments made in feeding cottonseed meal no account was taken of the quality of the meal fed or its composition, and it is not unlikely that many of the results may have been obtained by feeding damaged meal, as experimenters were not considered meal experts and with them meal was simply meal.

Dr. David Wesson, in his paper on "Cotton as a Food Crop" presented comparative statistics showing that on a fat and protein basis during the last year cotton ranked third among the great food crops of the country. Attention was called to the fact that chemists during the last fifty years have been devoting most of their attention to the development of the oil which has been practically perfected. The residue of the seed, consisting of from fifty to sixty per cent of protein, has been almost entirely neglected. This protein has a high biologic value and if purified by the removal of gossypol and other undesirable materials can be made into a wholesome human food which can be used as a meat substitute. He gave instances where he had made it into very palatable hash and croquettes, but did not however give any indications that people might expect sirloin or porterhouse steaks of cottonseed in the immediate future.

THE REFRACTOMETER AS AN AID TO THE RAPID ANALYSIS OF OIL BEARING MATERIALS

By H. C. FELLOWS

Industrial enterprises are constantly in search of methods of analysis which will shorten their routine laboratory work in such a manner as will give more efficient plant control.

Typical of such rapid methods now in use are those of the steel chemist for determining carbon, phosphorous, etc., of the sugar chemist for ascertaining the sugar content of syrups and of the cereal chemists for denoting the percentage of moisture in cereal grains.

There can be no question but that a test of a similar character would be of great assistance to the vegetable oil industry, as the buyer of oil bearing seeds would be then in a position to know within a short time the composition of his raw materials, and in addition the plant could be more efficiently operated as frequent tests could be made at short intervals to determine just what the presses were doing in so far as leaving oil in the cake was concerned.

Early attempts have been made by different vegetable oil chemists at one time or another to simplify the ether extraction method for making accurate oil determinations or to develop some rapid test which while not so reliable, as far as extreme accuracy is concerned, would give results sufficiently accurate for routine use in testing raw and finished products. As a practical matter, however, only one of the proposed short methods has proven worth while for the reason that the time element was not sufficiently reduced, that the expense of making the test was too great, that the accuracy, as compared with the standard methods was not sufficient, or that the method was not simple enough for the average analyst to carry out.

Of all the proposed methods, Wesson's[1] observation that he could measure the quantity of oil in cotton seed meal and meats by noting the change in the refractive index of a solvent known as Halowax (which chemically speaking, is a substituted napthalene) as it became diluted with cotton seed oil extracted from the sample of cotton seed under the conditions of the test, appeared to be the most worth while for consideration as a general method of study for determining the oil content of many of the oil bearing substances. For this reason, the method has been the object of study for some time at the Research Laboratories of the Grain Division of the Bureau of Agricultural Economics, United States Department of Agriculture. Among the commodities to which the method has been applied are linseed (flaxseed), and linseed meal, soybeans, mustard seed, peanuts, cocoa beans, and cocoa products.

The research relative to the use of the Wesson method in relation to determining the oil content of linseed (flaxseed), as well as the application of the method to the determination of oil in linseed meal has been very fully described in United States Department of Agriculture Mimeographed Circular G. I. 33, entitled: *A Simple Test for Determining the Oil Content of Flaxseed and Linseed Meal.* Suffice it to say as a result of this study, that with linseed and linseed meal the method worked ideally. Of the 120 samples of flaxseed analyzed 48.7 per cent of the samples tested by the optical method varied less than one-tenth of a per cent from the ether extraction method, 37.8 per cent varied greater than one-tenth of a per cent and less than .19 of a per cent, 14.3 per cent varied by greater than two-tenths and less than twenty-nine hundredths of a per cent, whereas only 4.2 per cent varied by more than three-tenths of a per cent, the greatest variation with all the samples tested being only .33 of one per cent. The samples tested varied in oil content from 29.86 per cent to 43.56 per cent. Similar success as attanied from the analysis of a large number of linseed meal samples.

Considerable progress has been likewise made towards developing the method for peanuts, cocoa beans, and cocoa products and with each of these commodities, on account of their high oil content, the question of securing a representative sample seems to be one of the points on which the adaptation of the optical method to their oil analysis depends. Among other materials on which the method is to be tried are corn germ meal and fish meal, crackling, mineral oil in parawax, and oiled paper.

Special Points for Consideration in Making the Test

In making the test several points of importance arise which should be watched in order to secure good results.

It is quite essential that the sample to be tested be thoroughly ground and in such a state of subdivision that intimate contact with the solvent is assured.

It has been found necessary to grind flaxseed with a small sized flouring mill, due to the fact that an attrition or burr mill mashes the flaxseed rather than cuts it, and likewise spreads the oil over the surface of the plates.

As usually received cocoa needs no grinding, and the cocoa bean can be successfully ground on a burr mill.

Due to the fact that the refractive index as well as the specific gravity of different lots of the solvent (Halowax) will vary, it is necessary to prepare standard conversion tables with each new lot of solvent and commodity tested. These tables must be made from a study of samples of Halowax and the oil under test of known composition.

The refractometer readings must be corrected for temperature changes because each degree change over or above a certain specified point will change the refractometric readings by approximately .00045, which value in the case of flaxseed is equivalent to three-fourths of a per cent of oil.

The Halowax vegetable oil mixture should be separated from the ground material by means of a small folded filter paper rather than by the cotton pellet method as recommended by Wesson.[1]

Care should be given to the refractometer and frequent use of the test slab should be made to keep the refractometric scale always adjusted to the same position.

Equipment Necessary and Time Consumed

The minimum amount of equipment necessary for carrying out the test by the refractometer method is as follows:

> Suitable grinding equipment, a refractometer capable of being read to the fifth decimal place, one pipette, one analytical balance, several mortars and pestles, small funnels, test tubes, folded filter paper, and absorbent cotton.

On the average it takes about 15 minutes to make a simple determination by the optical method. This time, of course, can be reduced if the tests are made in volume. This is in distinction to the 24 hours necessary to extract the linseed oil from flaxseed to the 16 hours necessary to extract cocoa butter from the cocoa bean and to the 3-4 hours necessary for the extraction of cottonseed oil from cottonseed meal.

The cost of making the test is also slight. After the initial expense of purchasing the equipment necessary for completing the test, the expense of reagents and so forth should not be over 2 cents per test.

U. S. Department of Agriculture
Washington, D. C.

[1] Wesson, David "New Optical Method for Determining Oil in Oil Mill Material. Cotton Oil Press," Vol. 4, No. 3, July, 1920.

THE EFFECT OF COTTONSEED FEEDING ON BUTTER FAT

By J. F. GEISLER

Cottonseed meal as a cattle food is of great economic importance. Because of its exceptionally high protein content it is of particular value in the dairy industry as an adjunct in the fodder rations, as it has been found to stimulate the production of milk besides improving the cattle through supplying them with norishing food. The effect of cottonseed feeding on butter fat has frequently been the subject of investigation and controversey.

Food affects the characteristics of butter fat, and to an extent greater than is generally supposed. Butter fat is milk fat. It is characteristically different from animal and vegetable fats and oils through its high content of what are collectively termed volatile soluble fatty acids, principally butyric and caproic. As long as cattle were fed or as long as they subsisted on grass, hay, clover and the usual farm products the variations in the composition of butter fat were not so noticeable or suspected, as they were in later years with the introduction of concentrated cattle feed; i.e., oil cakes and seed meals. These led to investigations which, through the use of more exacting critical analytical methods by numerous observers gradually established the fact that the composition of butter fat and departure from ordinary accepted standards was directly traceable to the kind and character of food.

As the cow is the medium for the production of the milk from which butter is made, it is of interest to briefly note some advances in the general knowledge of the effect of feed on the milk and thence on the butter fat. Thus Dr. Haase at the Agricultural Experiment Station in Moecken, Saxony, fed several cows, first upon hay, which he called normal fodder; secondly upon hay in connection with bean meal and rape meal, which are rich in albuminoids from which the cheese portion of milk is derived; thirdly upon hay in connection with oil and starch which contain carbohydrates from which the buttery portion of milk is derived. After a careful chemical analysis of the milk produced from several different kinds of food, he found so little difference in the corresponding kinds of milk that it could not be regarded of any practical account (U. S. Dept. Rep., 1871, p. 370). Dr. Kühn (Ibid, p. 370) who made several experiments on the same subject declares "that variations in fodder are not manifested in the quality of the milk, but in the quantity only." Dr. Wolff (Ibid, p. 370), Director of the Experiment Station at Hohenheim in Wurtenberg, who has conducted a long series of investigations on the subject, says "the quality of the food exercises no influence on the quality

of the butter in the milk except in the taste, while its influence becomes readily and distinctly manifested in the quantity of the milk yielded and in the increase or decrease of the live weight of the animals." Owing to inefficient methods in butter fat analysis up to that period, those opinions lose their edge of accuracy; for more efficient methods for butter fat analysis were not introduced until some years later.

Bearing on the increase of the yield of milk by feeding cottonseed meal Horace Colburn (U. S. Dept. Agr. Rep. 1869, p. 284) claimed "by feeding his cows 2 quarts each of cottonseed meal and fine meal per cow per day, in addition to hay, that in one week the cows thus fed doubled their yield of milk, the product also improved in quality while the animals made a decided improvement in appearance." Similar experience was reported by Leander Morey (Ibid, p. 440), and Belcher (Ibid, p. 440) as well as two other proprietors where cottonseed meal was fed liberally. Garget or constipation was not observed at any of these dairies as the result of the feeding. It would appear that these cows were exceptionally responsive in the increased yield of milk, and would need verification.

Definite differences in the effect of food upon the character of butter fat appear to have received recognition in 1874: "The character of the food has some influence on the character of the butter, but breed has more." (U. S. Dept. Agr. Rep. 1874, p. 254). Reaching a later period, the report by N. T. Lupton and Dr. J. T. Anderson: *Effect on Butter by Feeding Cotton Seed and Cotton Seed Meal.* (Bull. No. 25, New Series, Alabama Agr. Exper. Station, April 1, 1891) gives the details covering the investigation as to the composition of the various feeding rations and the effect of these upon the composition of the butter fat, showing a gradual lowering of the Reichert-Meissl number (ratio of volatile coluble fatty acids) from 30 to around 22, and the raising of the melting point of the fat gradually from 35 deg. C. to around 43 deg. C. These data together with finding that more or less definite color reaction for cottonseed oil was obtained on testing the butter fat, ought to effectually answer he question whether the feeding of cottonseed meal may affect the composition of butter fat. The data have been confirmed by others, as well as myself, and will be referred to later.

From researches by A. Zeitschek *On the influence of feeding stuffs on the composition of milk fat* (Landw. Vers. Stat. 74, (1911) No. 3-5, pp. 250-262) it is demonstrated that rations consisting of feeds which have a high iodin number, such as maize, bran, rapeseed cake, cause a rise in the iodin number of the milk fat, whereas the Köttsdorf and Reichert-Meissl numbers are lowered. The fat in the feeds influence the composition of the milk fat. Toward the end of the lactation period the saponification and Reichert Meissl numbers were lowered, while the iodin

number, refractive index, and melting point were raised. After change in feed the saponification and iodin numbers of the milk were quicker to change than the Reichert Meissl number. The physical character of butter is known to be affected by the kind of food; thus gluten meal, linseed meal and wheat bran are considered as productive of soft butters, while wheat straw and cottonseed meal are reputed to yield moderately hard to hard butters. In southern states and elsewhere where cottonseed meal has entered largely into the rations hard butters of high melting point are of frequent occurrence. Through the courtesy of C. D. Grinnells, in charge of Dairy Investigation, and R. Y. Winters, Director of the North Carolina Experiment Station at Raleigh, N. C., I was furnished with samples of butter which had been produced from the milk of cows under known conditions of feeding, amount of food and character of rations in which known percentages of cottonseed products played their active part. The series under way could not be completed in time for this paper, but two may be cited. They tell their story effectively. The feeding experiments were conducted from Dec. 4, 1925, to Feg. 11, 1926, during which period the feed for Groups I and III consisted of the following rations:

	Group I			Group III	
Concentrates	33.4%	Corn 16.6% Cott. S. M. 16.6%	32.1%	Corn 5.3% Cott. S. Meal 26.7%	
Roughage	66.6%	Alfalfa hay 22.2% Silage 22.2% Hull (Cott.) 22.2%	67.9%	Alfalfa hay Silage Cott. Hulls	22.8% 22.8% 22.3%

The analyses of the resulting butters showed the following:

	Group I	Group III
Reichert-Meissl No.	23.58	24.86
Polenske Number	1.76	1.38
Melting Point *	39.5° C	43.1° C
Congealing Point **	31. ° C	30. ° C
Iodin Number	36.53	37.41
Turbidity Test	87	85
Refractive Index	1.4540 (at 40°C)	1.4550
Consistency	Very firm	Very firm
Cotton seed oil reaction	Faint	Faint

Particular attention is called to the increase in melting point through the feeding of a larger per cent of cottonseed meal.

From an investigation of western butters recently made by me in the early part of September, 1925, it appears that there is a general lowering of the Reichert-Meissl number in the commercial butters of the New York Market. None of the twenty samples specially examined gave any reaction for cottonseed product, and from investigation regarding the feed, pasturage appears to have been the principal food,

and in none was cottonseed meal or concentrates a part of the rations.

The following are the analyses of these twenty samples of butter from the New York market:

	Reichert Meissl No.	Polenske No.	Iodin No.	Melting Point*	Congealing Point**	Turbidity Test
No. 1	25.90	2.12	39.87	37.0°C.	27.2°C.	52.
2	25.71	1.91	38.67	38.2°C.	26. °C.	60.
3	26.09	1.98	39.37	38.5°C.	25.8°C.	56.
4	23.26	1.78	39.79	38.3°C.	27. °C.	68.
5	25.84	1.77	40.40	37.2°C.	27.2°C.	52.
6	25.44	2.04	41.42	38.8°C.	27. °C.	56.
7	25.90	1.86	39.33	37.2°C.	27.5°C.	50.
8	27.16	2.08	39.20	36.5°C.	26.8°C.	52.
9	26.41	2.00	38.84	38.0°C.	27.8°C.	51.
10	27.06	1.92	40.5	38.0°C.	27.5°	58.
11	24.86	1.84	42.5	38.3°	27.2°	54.5
12	24.92	1.38	42.17	38.3°	27.5°	55.5
13	26.83	1.88	39.73	38.5°	27.8°	55.5
14	26.27	2.01	38.56	37.0°C.	27.3°C.	49.
15	25.91	1.66	38.56	37.2°C.	28.0°C.	49.5
16	24.90	1.44	43.87	38.3°	27. °	48.
17	24.29	1.51	44.08	38.3°	26.6°C.	53.
18	27.14	1.70	41.53	38.5°	27.5°	53.
19	25.6	1.84	38.00	37.2°	27.2°	47.
20	28.24	1.83	38.60	37.2°	24.6°	46.

NEW YORK, N. Y.
April 3, 1926

*Regarding the Melting Point the degrees here recorded represent the temperature at which the melted fat finally clears. Butter fat being a mixture of glycerides of varying melting points usually softens around 29 to 30° C. and at 32 to 34° C. becomes semi-transparent. However 1 to 2 per cent of the mass does not melt clear until a higher temperature is reached and represents a more fixed determinable factor.

**The Congealing Point is the degree at which the melted fat shows the first signs of crystallization on cooling.

THE NON-OXIDIZABILITY OF VITAMIN A IN FOODS

By E. F. KOHMAN

There are in existence statements of rather recent date to the effect that we are in grave danger if we rely for our vitamins on cooked foods. It has been stated that we should eat raw foods at least twice daily because no cooked or canned foods can supply us with sufficient vitamins. Numerous other similar statements could be recalled but for brevities sake they will be omitted.

Vitamin C is regarded as being the vitamin most easily lost but vitamin A shares with it this reputation of delicateness. Although formerly heat was commonly designated the destructive agent, it now seems to be more popular to ascribe it to oxidation, and it is even admitted that in some cases this may be avoided. In a recent editorial the *Journal of the American Medical Association* says: "The reports of the destructive effects of heat have been grossly exaggerated. The liability seems to apply more particularly to vitamins A and C and to depend largely on the conditions of heating employed. When the possibility of oxidation is precluded, as in commercial canning rather than open air heating, the loss of vitamins is greatly reduced if not actually negligible.

The point I wish to make is that the oxidation of vitamin A in foods in general, within the practice of food handling, is not only highly improbable but practically impossible.

Several years ago Drummond and Coward showed that vitamin A in butter fat is susceptible to destruction by oxidation. For example, butter fat in shallow dishes at 95°C lost its vitamin A fairly completely in 3 hours, while when heated under the same conditions with the exclusion of air their was no loss in 15 hours. Admitting this susceptibility to oxidation, where in the food industry do such conditions obtain that permit of oxidation. Drummond and Coward at the same time showed that live steam could be passed through butter fat for 6 hours with no loss of vitamin A, and Hopkins showed that butter fat lost no vitamin A upon autoclaving 4 hours at 120°C. It is possible that had oxygen been passed through at the same time it might have had a destructive effect but such conditions are not met with in the handling of foods.

Platon[2] reports a comparison of the vitamin A content of butter made in the usual way as against its being made in an atmosphere of carbon dioxide. He could detect no difference to denote any destruction of vitamin A in the ordinary process. Vitamin D is even less susceptible to destruction since it is now general practice to rid fats of vitamin A by heating in the presence of oxygen whereby the vitamin D is not seriously diminished, though it too may be destroyed by excessive treatment.

When we consider vitamin A in food products other than fats we find

conditions even less likely to permit of oxydation. Steenbock and Boutwell[4] autoclaved yellow maize, chard, carrots, sweet potatoes, squash and alfalfa for 3 hours at 121°C with no evidence that vitamin A was appreciably reduced. This is in line with our own experience. We have doubled the process of canned peas[5] from 25 minutes to 50 minutes at 120°C and after both processes found the canned peas equivalent to raw in vitamin A content. Extending the commercial process of canned spinch[6] from 70 minutes at 110°C to 120 minutes gave us no evidence that vitamin A was dmiinished in either case.

It is evident, therefore, that we may indulge in broiling, stewing, roasting, cooking or baking as it suits our gustatory fancy with no fears of depriving ourselves of this particular vitamin. With the question--what would be the result of bubbling oxygen through a moist food while it is being cooked, we hardly need concern ourselves, since we can content ourselves with the assurance that foods are never subjected to such conditions.

RESEARCH LABORATORIES, National Canners Association, Washington, D. C.

[1] Drummond and Coward--Biochem. Jr. 1920, 14, 734.
[2] Hopkins, Brit. Med. Jr. 1920, 2, 147; Biochem. Jr. 1920, 14, 725.
[3] Platon, Biochem. Ztscher. 1925, 155, 228.
[4] Steenbock and Boutwell, Jr. Biol. Chem. 1920. 41, 163.
[5] Eddy, Kohman and Carlsson, Ind. End. Chem. 1926, 18, 85.
[6] Eddy, Kohman and Carlsson, Ind. End. Chem. 1925, 17, 69.

COTTON AS A FOOD CROP

By DAVID WESSON

Although cotton is not usually shown in statistical tables as a food crop, it is really a food crop of great importance. Statistics are interesting things to play with, and as a rule make dry reading, but they have to be resorted to at times to give us a proper sense of proportion.

The cotton crop for the season 1925-6 was close on to sixteen million bales of staple and eight million tons of cottonseed. Each bale of ginned cotton of five hundred pounds carries with it one thousand pounds of seed when it goes to the gin.

Table No. 1 shows the production of the leading food crops in bushels and tons. The statistics give them in bushels, but for comparative reasons they have to be reduced to tons.

TABLE I THE PRINCIPAL FOOD CROPS OF THE UNITED STATES, 1925

	Bushels	Tons
Corn	2,918,000,000	81,726,000
Oats	1,470,000,000	23,520,000
Wheat	697,000,000	20,093,000
Cottonseed	533,000,000	8,000,000
Potatoes	344,000,000	8,600,000
Barley	227,000,000	5,450,000
Rye	52,000,000	1,450,000

TABLE II. WEIGHTS PER BUSHEL AND BUSHELS PER TON

	Lbs.	Bu. per Ton		Lbs.	Bu. per Ton
Corn	56	35.80	Potatoes	50	40
Oats	32	62.50	Barley	48	41.6
Wheat	60	33.33	Rye	56	35.80
Cottonseed	30	66.66			

Table II shows the reason. Could we have any better argument for adopting the metric system?

Cottonseed is practically a small nut averaging 55 per cent kernel and 45 per cent shell or hull. The shell is similar in texture to that of the chestnut. The kernels are very rich in oil and protein.

For comparative purposes the contents of the whole seed are taken and the fat and protein values of the several crops are given as follows:

TABLE III PERCENTAGES OF PROTEIN AND FAT IN FOOD CROPS.

	Protein	Fat		Protein	Fat
Cottonseed	21.5	20	Barley	11.2	2.1
Wheat	13.2	1.6	Corn	10.6	6.5
Oats	12	6	Potatoes	2.0	.6
Rye	11.4	1.7			

The protein and fat values of the different food crops for the past year are given in table IV.

TABLE IV TONS OF PROTEIN AND FAT IN THE SEVERAL CROPS.

	Protein		Fat	
Corn	8,662,956	Tons	5,312,840	Tons
Wheat	2,652,276	"	1,600,000	"
Oats	2,824,000	"	1,411,200	"
Cottonseed	1,720,000	"	321,488	"
Barley	610,400	"	114,450	"
Rye	165,300	"	24,650	"
Potatoes	172,000	"	51,600	"

To measure up the value of the relative importance of the above crops on a fat and protein basis, another table has been prepared, which shows cottonseed in the third rank of the great food crops. In looking at these comparisons, however, we must bear in mind that crops vary from year to year, and while cottonseed might show up third as a fat protein producer this year, it might drop to the fourth place in a year, when we only had a ten million bale crop. The following table is for the year 1925:

Corn	13,975,796	Tons	Barley	724,850	Tons
Oats	4,235,200	"	Potatoes	223,000	"
Cottonseed	3,320,000	"	Rye	189,950	"
Wheat	2,973,276	"			

With the figures given in the above tables, which were worked up from the data published by the Department of Agriculture, we can readily believe that cotton is a food crop of high rank. Let us see what we are doing to utilize it.

In 1826, Dr. Benjamin Waring established a paper oil and grist mill at Columbia, S. C., Georgia had an oil mill in 1923.

About 1878 the chemist came into the field, and since that time, one improvement after another has taken place in the refining of the oil and the preparation of the edible fats, until there is but a small field left in this country for the oil of the olive; while the lard of the hog has been equalled if not surpassed by the various excellent cooking fats now on the market made entirely from the once despised cottonseed. Without the oil of the cottonseed, there would not be enough cooking fats to go around with our constantly increasing population.

During the years of development which have brought cottonseed oil and its products to their present high state of perfection very little attention has been given to the meal, which the seed carries in greater quantity than the oil. It is believed that the day is fast coming if it is not here already when the meal now selling at $30 to $40 per ton will be made into as valuable a food product as the oil. There is no more fertile field right now for the chemist than the development of important valuable food material which is now used chiefly for feeding cattle and the manufacturer of fertilizers.

Let us face the problem fairly, and see what we are up against.

We will begin our analysis by going right straight back to the cottonseed.

The Cottonseed

We have talked a great deal about cottonseed in terms of tons. Let us take it into the laboratory and examine it with the microscope, and then by chemical analysis. Through the courtesy of Dr. Winton, an illustration shows a cottonseed in section, horizontally and longitudinally. The seeds are actually about three-eighths of an inch long. One hundred of them weigh 10 to 12 grams, according to the variety, and it takes 7 million about to make a ton. The plate shows us an outer hull with adherent fibers, surrounding the meat or kernel, consisting of the folded cotyledons or seed leaves. Little colored dots are seen all through the meats. These carry the dark coloring matter which comes out with the crude oil.

The second illustration shows an enlarged section and gives us a better idea of the cell structure. As might be expected, seed vary according to locality and climate. The following are typical analyses of Georgia and Texas seeds and also the yield of products:

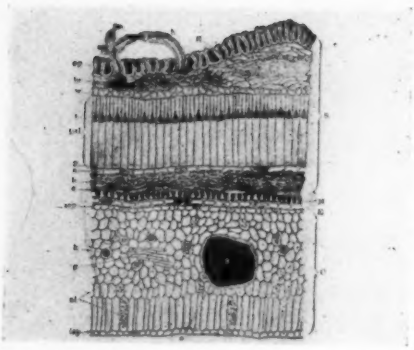
Cottonseed Analyses

	Georgia Per Cent	Texas Per Cent
Hulls	45.00	47.00
Meats	55.00	53.00
Oil in meats	37.00	31.20
NH_3 in meats	6.60	8.40
Protein in meats	36.99	43.50
Mill yields per ton of seed:	Pounds	Pounds
Cake	1,010.00†	1,056.00†
Oil	337.50	256.00
Linters	155.00	145.00
Hulls	375.00	515.00
Loss	123.00	100.00
†NH_3 in cake, per cent	7.16	8.00
Protein	44.5	50.00

In studying the analyses we will notice the high cake and the low hull yields. This is because in milling it is better practice to lose some hulls in the meat than meats in the hulls. These analyses made during the war, show very large lint yields which of course means that there was just that much less hull. Present practice since the war is to remove only about 100 lbs. of lint, thus making more hulls.

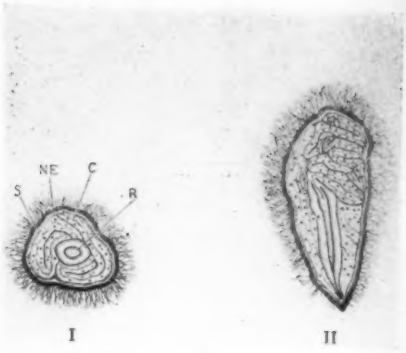
A further study of the analyses shows the large amount of protein in the cake which is mostly ground up and used as meal for cotton food. Investigations by O. Breese Jones, Bureau of Chemistry,[1] and Thomas B. Osborne and Lafayette Mendel[2], show that the protein of cottonseed is of a very high nutritive value.

In the present method of oil milling, the meal or cake carries about



COTTONSEED (CROSS SECTION)

S Spermoderm consists of cp Epidermis with hair, br Outer Brown Coat with R Raphe, w Colorless Cells, pal Palisade Cells, and b and c layers of Inner Brown Coat; N Perisperm; E Endosperm; c Cotyledon with p Outer Epidermis and icp Inner Epidermis; s Resin Cavity surrounded by z Mucilage Cells; al aleurone grains; k Crystal Cells; g Procambium Bundles.



COTTONSEED

I Transverse Section. II Longitudinal Section. S Spermoderm: NE Perisperm and Endosperm; C Cotyledons; R Radicle.

6 per cent oil and considerable gossypol. The oil in the cake grows rancid. The gossypol under certain conditions is poisonous, it imparts unpleasant flavor and the hulls are indigestible for humans.

It is possible to separate the meats of the cottonseed without the hulls, and to remove all its oil and gossypol by solvents, so as to obtain a product containing about 55 per cent protein. This protein makes a good meat substitute. With cottonseed meal costing $50 per ton carrying 50 per cent of protein, we get 1,000 lbs. of protein for $50 or our protein costs 5 cents per pound.

With beefsteak at 40 cents per lb. containing 20 per cent of protein, we pay $2.00 per lb. for the protein. Synthetic beefsteak is almost within the reach of the research chemist. Synthetic hash has already been produced, and it was good hash too.

Going on the theory that meat carries about 80 per cent water, the specially prepared cottonseed meal was mixed with three parts of water. which gave it the consistency of a very stiff porridge. This was mixed with potatoes and onions properly seasoned with salt and pepper and fried in cottonseed oil. It was impossible to tell the difference between this and good plain everyday hash.

There is on the market today a material sold and used as a beef extract for making beef tea, which is made by peptonizing the proteins of wheat. Is there anything extravagant in the idea that a valuable meat substitute should not be made from the protein of cottonseed?

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[1] Poteins of the Cottonseed, D. Breese Jones and Frank A. Csonka, The Journal of Biological Chemistry, Vol. LXIV, No. 3, July, 1925.

[2] The Use of Cotton Seed as Food, Thomas B. Osborne and Lafayette B. Mendel, The Journal of Biological Chemistry, Vol. XXIX, No. 2, March, 1917.

A METHOD FOR THE ANALYSIS OF COTTON SEED

By C. H. COX

The perfection of a method for the analysis of cotton seed that will accurately represent the value of a given lot of seed in terms of pounds of cotton seed oil and cake that can be produced, has been the subject of a large amount of work by many analysts.

Several methods have been, and still are in use with varying degrees of success.

The method of weighing a portion of seed, cutting by hand, then picking out the meats for analysis and reweighing the picked hulls, to determine the percentage of meats and hulls, has probably been in use the longest and by the greatest number of operators. This method, however, is subject to numerous errors, probably the greatest being in getting the correct percentage of meats and hulls. Careless picking and a change in the moisture content of the hulls while being worked, are two factors very difficult to control. It is also obviously impossible to work on a sample of sufficient size to insure accuracy.

The various methods of extracting a weighed sample of whole seed after grinding or crushing are subject to the same error—the small size of the sample—a few more or less than the average number of immature seed giving erroneous results.

The solution of the problem seemed to be in some method by which a sample of seed, large enough to be representative, could be ground to a homogeneous mixture. The analysis of such a mixture would be comparatively simple.

Every analyst who has worked with cotton seed is familiar with the fact that the lint adhering to seed makes it impossible to grind them to a homogeneous mixture, for the lint, the hull and the kernel separate and no amount of turning, shaking or rolling will remix them well enough to allow of representative samples being weighed from the mass.

Several years ago Malowan, of Houston, Texas, proposed to treat seed with hydrochloric acid, dry and then grind for analysis; the acid attacking the lint and so changing its character that after partial drying the seed can easily be ground and mixed to a product entirely suitable for analysis.

The idea was entirely practical, but the difficulty in this procedure lay only with the method of applying the acid. Too much acid or too close contact invariably charred a portion of the sample.

The problem of finding a method of bringing the gaseous acid in contact with the lint on the seed was attacked from a number of angles. Seed were placed in several different types of containers over an aqueous

solution of hydrochloric acid, and the acid volatilized by heating. In every instance it was found impossible to treat the seed evenly throughout, some getting too much acid and some too little, and where the acid in too concentrated form came in contact with the seed charring always took place. Passing the gas from an outside generator into a vessel containing the seed was tried, but is subject to the objection that it is hardly adaptable to a large number of seed samples, and further, it is wasteful, in that it is difficult to regulate the amount of acid to varying numbers of samples; it being necessary to obtain a sufficient concentration of gas in the vessel containing the samples regardless of the number of samples contained.

After some work we decided that if the acid were absorbed into the walls of a porous vessel filled with seed and then this vessel were heated slowly, the acid would be liberated in such a manner that all of the seed would be acted upon in about the same degree.

The absorbent vessel finally selected is an ordinary two and a half inch flower pot—the kind used by florists for small plants. They readily absorb the acid, hold fifty to sixty grams of cotton seed, and a large number can be packed at one time into a suitable oven. They are easily obtainable and inexpensive, so that when they cease to absorb the acid through glazing of the surface, they can be replaced.

From 1.0 to 1.5 cc of concentrated Hydrochloric acid are allowed to run down the sides of the pot from a pipette or burette and the pot turned about until it has all been absorbed. It is then loosely filled with fifty to sixty grams of seed and placed in a ventilated air oven and heated to 115 deg. to 125 deg. C from one to one and a half hours, depending on the moisture content of the seed. This treatment leaves the seed with a moisture content of from 3 per cent to 8 per cent and in such condition that they can be readily ground and mixed without danger of subsequent separation of the hulls and lint from the meat. The usual quantities are then weighed out for moisture, oil and ammonia and the moisture and ammonia are determined exactly as in a cotton seed meal. The oil determination requires a longer extraction and unless the grinding is very well done—so that everything will pass a 30 mesh screen—the partially extracted material must be taken down at the end of two hours, ground in a porcelain mortar and re-extracted for two hours more. If the seed are well dried and ground, however, a rapid percolating extraction will get practically all the oil in four hours.

A moisture determination is made on the original seed by drying at least eight hours at 100 deg. to 102 deg. C and the determinations made on the partially dried seed are reduced to the original moisture basis as follows:

M = Moisture in original seed
P = Moisture in partially dried seed
F = Factor to use to reduce to original basis

$$(100 - M \div (100 - P) = F.$$

These calculations are easily made on a twenty-inch slide rule with sufficient accuracy. In reporting the figures to the oil mill or seed shipper, we report available ammonia; this figure being obtained by substracting 0.21 per cent from the total ammonia.

To obtain the available oil in the seed we must first find how much oil will be left in the cake produced. As cotton seed contain anywhere from three to four and one-half per cent ammonia and produce from 750 to 1050 pounds of 8.37 per cent ammonia cake in calculating the oil remaining in the cake we must always take into account the indicated yield as shown by the ammonia determination. Then if we assume a constant relation between the oil and ammonia content of the cake we can easily find the oil left in the cake by multiplying the pounds of cake produced by the percentage of oil remaining in the cake. This oil and ammonia relation is based on a standard figure of 80 to bring the oil yields of all seed to the same basis regardless of the grade of cake being produced. That is if 7 per cent ammonia cake is being made the oil content is assumed to be 5.60 per cent; if 8 per cent ammonia cake, the oil is 6.40 per cent.

The resultant figure obtained by multiplying the percentage of oil in the cake by the indicated yield of cake is subtracted from the total oil and this figure reported as available oil.

This method has been in use in our laboratories during the season just closing and has stood the test in every way. It readily adapts itself to volume. It is very easy to keep account of samples by numbering the pots. Duplicate determinations give close checks and abnormally high or low results are almost unknown.

On several test runs, where we have analyzed every car of seed worked, we have calculated within a very close margin, the yields of cake and oil obtained by the mills.

This method is now in the hands of the Seed Committee of the American Oil Chemists' Society and is being tried out by them.

BARROW-AGEE LABORATORIES, INC.
Memphis, Tenn.

SOAP COLOR TEST OF SULPHUR OLIVE OIL

By H. P. TREVITHICK and W. H. DICKHART

Sulphur olive oil, commonly called olive oil foots, is the residuum oil extracted from the olive pulp by carbon bisulphide, after the removal of edible and commercial oil by pressure. The oil is used for textile and soap manufacture, and the commercial value is determined by its moisture and insoluble contents, and by the color of the soap produced from it by saponifying it with caustic soda.

The New York Produce Exchange has the following rule on this oil; 'To grade prime green, the foots must be fair average quality of the season's production, and must saponify with 20° Beaume caustic soda and not turn brown, when tested as above for green oil." The extract of the rule on olive oil applying to this reads as follows: "When saponified with a solution of caustic soda in the proportion of 8 c.c. to 10 grams of the oil, hot."

As practiced in this laboratory, 10 grams of the oil in a three or four inch evaporating dish are heated on the steam bath, and stirred with 8 cc of the required caustic soda thoroughly. After standing five or ten minutes on the bath, the soap is again thoroughly stirred. After about an hour total time, the soap is examined and should not be brown. Actually, many of the samples are a brilliant dark green especially in the beginning of the season, in February or March, but the colors vary from this through various shades of olive green to brown. According to the rule, any soap that is not brown grades "prime green" but no grade is established for the samples which are better than the others, such as a "choice" green. Due to that fact, many lots are sold on sample, as certain soap-makers seem to require a better green color than others.

The question of this soap color has been discussed for some time, and lately this laboratory resolved to study this question more thoroughly. No really definite results have been obtained but a method has been developed whereby the color has been read in the Lovibond tintomter with considerable success, and seems to give promise of good results. The method and procedure are being given here for further discussion and cooperative work by any who may be interested.

After saponifying the oil as above, the soap was allowed to stand on the bath for about two hours total time, and then after cooling dissolved in 250 c.c. of alcohol, and a 50 c.c. aliquot of this made up to 200 c.c., giving a soap solution containing 1 gram of oil in 100 c.c. of alcohol. After filtering, the color of this solution was read in the usual manner, using 5¼ inch column of solution. In reading the color, a one unit blue glass was used on all readings, and the red and yellow varied.

We have grouped these readings so that the best ones are in the

first group, and might be used for a choice grade, and the rest are divided between the prime but not choice samples, and the off samples.

RESULTS OF TESTS FOR COLOR

Soap Color (NYPE test)		Grade (NYPE)		Lovibond reading Blue	Yellow	Red
Excellent	Green		Prime Green	1.0	6.0	0.5
"	"		" "	1.0	6.0	0.7
"	"		" "	1.0	8.0	0.5
"	"		" "	1.0	5.5	0.1
"	"		" "	1.0	6.0	0.1
Good	"		" "	1.0	5.5	1.0
"	"		" "	1.0	7.0	1.0
"	"		" "	1.0	8.0	1.7
"	"		" "	1.0	8.0	1.0
"	"		" "	1.0	5.5	0.5
"	"		" "	1.0	3.5	0.3
Poor	"		" "	1.0	9.0	1.4
Brown	"	Not	" "	1.0	11.0	2.0
"		"	" "	1.0	12.0	2.1
"		"	" "	1.0	39.0	7.7
"		"	" "	1.0	35.0	3.6

This method seems to give promise that it may develop into a method which may be better than the other, but we would like to see results by others. It would seem that all colors under 1.0 red might be graded "choice" and all under 2.0 prime: but of course further results are necessary before any definite conclusions can be drawn.

NEW YORK PRODUCE EXCHANGE, NEW YORK.
March 18, 1926.

THE INFLUENCE OF GEOGRAPHICAL SOURCE OF SEED ON COTTON OIL

H. J. MORRISON AND L. W. BOSART

The authors of this paper attempted recently to collect data in order to determine, if possible, whether any relationship exists between the stearin content of cotton oil and the locality from which the oil was derived, or, more properly, in which the seed was grown, or to what other causes such differences were due. Inquiries directed to chemists expert in matters pertaining to cotton oil, and to the various experiment stations, brought forth little or no information which would make this matter clear. It was, therefore, decided to tabulate what information we had on hand and to see if this would point the way to a solution of the problem.

In the preparation of winter oil, it is found that some cotton oils are so high in stearin that they cannot be used at all for this purpose, whereas there are others which contain so little stearin that they will stand the ordinary chill test without the removal of any stearin by cold pressing. The latter condition may be in part due to stearin having grained out in storage.

The differences might conceivably be due to one or more of several causes, viz.: the variety of the cotton plant, the nature of the soil fertilization, methods of cultivation, climate, time of planting and harvesting, and the maturity of the seed from which the oil is pressed.

Except for Sea Island cotton, which forms a very small proportion of the total planting, the American cotton is produced practically from only one species, Gossypum hirsutum, or from forms which are merely variations of this due to local conditions of cultivation or climate. There appears, therefore, to be little likelihood of finding differences in the oil due to differences of species. No information was obtained regarding differences due to different varieties. Variety is probably closely coupled with soil, climate, and cultivation.

Any differences due to soil, cultivation, or fertilization, could be determined only by actual field tests covering a period of several years.

No data were available as to the probable effect of the maturity of the seed nor to the time of planting and harvesting. Owing to the ravages of the boll weevil, there has been a decided tendency toward early planting. This would give the seed a longer time in which to mature and this, in turn, may affect the character of the oil. In fact, for the past two seasons, the amount of oil which could be used for making winter oil has been less than in previous seasons, and there may be some connection between this and the tendency to early planting and, consequently, greater maturity of the seed.

Jamieson and Baughman* made tests showing the refractive indexes,

* Cotton Oil Press, Volume 4, No. 3, Pages 85 to 87; No. 6, Pages 48 to 49.

iodine values, titers, and the proportion of saturated fatty acids to unsaturated, in oils from seed from various geographical locations. They found that there is only a slight variation in the characteristics of the oils from the various parts of the United States.

Their results show twenty-one oils from mills south of the thirty-fourth parallel and twenty north of it. We find that if we take the average figure for the characteristics which they found for oil south of this parallel and for those north of it, the northern oils are slightly higher in iodine value and refractive index and somewhat lower in titer and saturated fatty acids. The average figures are as follows:

TABLE I

	Iodine Value	Refractive Index	Titer	Saturated F. A.
Oils north of latitude 34°	107.87	1.46967	34.035	24.030
Oils south of latitude 33°	107.06	1.46951	34.276	25.057

Although the figures do not differ widely, they show that the more northerly oils are apparently softer, i.e., contain less stearin than the southerly ones. Moreover, curves plotted from their figures show a general but irregular trend toward softer oils going from south to north. The number of results obtained, however, are not sufficient to draw any definite conclusions, and this may be merely chance.

In order to learn whether there is actually a difference between oils according to geographical location, we examined oils received at Ivorydale from mills from various localities over a period of several months. These oils are refined in the regular course of procedure as they are received from the tank cars, and the butyro-refractometer reading is made on the refined oil. This determination is made as a matter of routine on all oils received. During this period, oils were received from the following states: Tennessee, Georgia, Alabama, Mississippi, Arkansas, Oklahoma, Texas and Louisiana. There were 822 different samples on which the refractive index was read, and these we have tabulated. Each represents a separate tank car lot received early in the year 1926. Mills in sixty-six different towns are represented. It was, of course, not practicable to make determinations of the iodine value, titer, and saturated fatty acids on such a large number of samples, but since there is a quite definite agreement between the refractive index and the other characteristics, it was considered that this determination alone was sufficient to establish the character of the oil. (It has been found that one degree on the butyro-refractometer scale means an average of 6.08 in the iodine value of cotton oil.)

In considering the results, it must be borne in mind that the oil from a particular mill is not necessarily representative of the oil from its immediate vicinity in all cases. The fact also must not be lost sight of that

some of the oils received may have grained out and separated stearin in storage. Some of the mills are large ones and may draw seed from a wide territory, e.g., all but a few of the oils from the section east of the Mississippi and north of the thirty-fifth parallel came from Memphis. It is quite probable that much of the seed from which this oil is obtained comes from Arkansas or Mississippi, therefore, from territory west of the Mississippi and south of the thirty-fifth parallel.

Table II hows the average refractive indexes for oils in different latitudes across the country within the cotton-growing territory.

TABLE II

Group	Latitude	Number of Samples	Average Refractive Index
1	South of 32°	7	50.93
2	32°-33°	180	50.81
3	33°-34°	191	50.84
4	34°-35°	151	51.09
5	35°-36°	280	51.12
6	North of 36°	13	51.15

These results show an increasing refractive index going from south to north, with the exception of oil from territory south of 32°, but there are only seven oils in this group, and they cannot, therefore, be considered sufficient in number to be representative. Although the group north of 36° falls in line, it also contains too few oils to be representative.

The oils were then divided into two lots, as it was thought that there might be a difference due to climatic conditions east and west of the Mississippi. The results are shown in Table III.

TABLE III

		East of Mississippi River		West of Mississippi River	
Group		Number of Samples	Average Ref. Ind.	Number of Samples	Average Ref. Ind.
1	South of 32°	4	50.80	3	51.10
2	32°-33°	170	50.82	10	50.85
3	33°-34°	173	50.85	18	50.65
4	34°-35°	38	50.87	113	51.16
5	35°-36°	106	50.96	174	50.98
6	North of 36°	6	51.28	7	51.03

In the division east of the Mississippi, there is a definite trend toward higher results going from south to north. Groups 1, 4, and 6 do not have enough samples to give dependable figures. The division west of the Mississippi has only two groups with a considerable number of oils in each, and these show a higher refractive index in the more southerly group, which is out of line with the apparent trend.

If the country be divided into two sections, viz.: that east of the Mississippi and that west of it, or into two other sections, that south of 34° latitude and that north of 34°, we find the following results:

TABLE IV

	Number of Samples	Refractive Index
East of Mississippi River	497	50.87
West of Mississippi River	325	51.15
South of 34°	378	50.83
North of 34°	444	51.11

It will be seen from this that oils with higher refractive indexes are to be expected west of the Mississippi and north of latitude 34°.

Going a step farther, we can divide the country into four parts, using the thirty-fourth parallel and the Mississippi River as dividing lines.

TABLE V

	Number of Samples	Refractive Index
Southeast-east of the Mississippi and south of 34°	347	50.83
Northeast-east of the Mississippi and north of 34°	150	50.95
Southwest-west of the Mississippi and south of 34°	31	50.76
Northwest-west of the Mississippi and north of 34°	294	51.19

These four sections range according to their increasing refractive indexes as follows: southwest, southeast, northeast, northwest. The southwest section has too few representatives to give a reliable average, but certainly the northwest section, which includes most of Arkansas and Oklahoma and a portion of Texas, may be expected to furnish oils with the highest refractive indexes and, consequently, with the lowest amounts of stearin.

Further groupings were made leaving out oils south of 32° and north of 36°, as they are few in number and have little bearing on the general results. The results are shown in the following table:

TABLE VI

	Number of Samples	Refractive Index
East of the Mississippi 32°-36°	487	50.87
West of the Mississippi 32°-36°	315	51.15
East and west of the Mississippi 32°-34°	371	50.83
East and west of the Mississippi 34°-36°	431	51.11
Southwest section	28	50.72
Southeast section	343	50.83
Northeast section	144	50.94
Northwest section	287	51.19

These limitations in no way change the results or conclusions to be drawn. It was considered merely that there were not enough samples from oils south of 32° and north of 36° to make their consideration of much value.

Conclusions

The results indicate, in general, a higher refractive index, consequently, a higher iodine value, lower titer, and a lower amount of stearin in the oil the farther north the seed is grown. The seed from the northwest section of the cotton country—most of Arkansas and Oklahoma and part of Texas—should give oils with the lowest amount of stearin.

The authors wish it to be understood that they feel that conclusions cannot definitely be drawn from the data given, since they are taken from oils from a limited number of mills; there are no representatives of oils from some of the states; there are many samples from certain individual mills and only one or two from others; finally, they represent seed from the latter portion of the season and only one season's milling. The conclusions, however, agree with a very general impression, gained from determinations of titer and other characteristics, that the farther north the seed is grown the less stearin the oil contains. Pigulevski* has already pointed out an analogous variation in the case of the seed oil of certain essential oil bearing plants in which the iodine value increased as the geographical location extended toward the north. It will be necessary to carry on the work of collecting and tabulating the data in future seasons in order to know to a certainty whether the geographical origin of the seed has any influence on the character of the oil.

THE PROCTER & GAMBLE CO.,
Ivorydale, Ohio.

*J. Russ. Phys. Chem. Soc. **47** (1915), 395-405 and **48** (1916), 324-421, through J. Chem. Soc. **108**, I, **758** and **112**, I, 189.

QUANTITATIVE DETERMINATION OF LINT ON COTTON SEED

By T. L. RETTGER

Since the end of the War and the subsequent decrease in the manufacture of nitrocellulose the determination of lint on cotton seed has lost much of its importance. It is of value, however, in showing the amount of lint available on seed from different localities; in making a true comparison of the efficiency of different mills; and in showing the amount of fiber available after delinting.

Present methods of determining lint are troublesome and inaccurate, with an incalculable personal equation. The method given below is simple and quick; duplicate determinations agree within the limits allowed by the inequality of the material; and results are accurately indicative of actual mill yields.

The writer acknowledges the credit due to John Malowan, whose method of treating seed with Hydrochloric Acid for oil determination suggested this method for lint.

The Method

From the well-mixed and cleaned sample of cotton seed weigh approximately 10.2 grams, eliminating all broken and immature seed. Put 8 to 10 drops of 40 per cent Hydrochloric Acid on the bottom of a small beaker. (A 75 c.c. assay beaker is preferred.) Place the sample loosely in the beaker, protecting it from direct contact with the acid by a disc of monel metal screen. Cover the beaker with a watch glass and heat for ten minutes. This may be done in an oven at 110° C. or on a hot plate with a surface temperature of 140° C. Remove the cover and heat for an additional ten minutes; then spread the sample on a clean surface to cool. Weigh to the closest centigram and rub in a pocket of cloth with a rotary motion to remove the hydrocellulose. Dump on a sieve to clean (a popcorn shaker is satisfactory) and reweigh. The loss in weight is lint. In rubbing the seed small particles of hull are removed with the lint, giving high results. To determine this blank, treat a sample of bald seed as for lint. Subtract the percentage loss from all lint determinations. A large number of analyses has established the blank as 0.6 per cent. Three determinations of lint should be made on each sample and the average reported, as 30 grams of cotton seed is required for a representative sample.

A comparison of results by this method with actual lint cuts is given below. When the lint on seed before and after delinting has been determined the amount of lint cut is calculated as follows:

100 — (% Lint on Original — % Lint on Delinted) = ×. × (%

Lint on Delinted) = % Lint on Delinted, Original Basis. % Lint on Original — % Lint on Delinted, Original Basis = % Lint Cut.

No. 1. Mill Cut 36 Lbs. per Ton.

	% Lint on Original	% Lint on Delinted	% Lint Cut	Lbs. per Ton By Analysis
	10.9	9.4		
	10.7	9.0		
	10.5	8.7		
Avg.	10.7	9.0	1.85	37.

No. 2. Mill Cut 78 Lbs. per Ton.

	10.6	6.6		
	11.0	7.0		
	11.0	7.2		
Avg.	10.9	6.9	4.28	85.6

Buckeye Cotton Oil Co.
Memphis, Tenn.
Apr. 2, 1926.

CHALLENGES DR. WILEY'S STATEMENT

Editor, JOURNAL OF OIL & FAT INDUSTRIES:

In the March issue of THE JOURNAL OF OIL & FAT INDUSTRIES, page 84, second paragraph, Dr. Wiley makes the statement, "The great function of fats and oils is to supply heat, and through heat, energy. Many people think that the fats which we eat enter into the fats of the human body. This is not the case. All the fats we eat are burned in the body. The fats that are deposited in our bodies are made from sugar and starch and not from the fats we eat."

This is at variance with the present day conception and the work of the physiological chemists. The literature is full of authoritative and convincing facts to show that the body fat of various animals can be and is directly deposited from the fats ingested. I give you below illustrations:

In "Feeds and Feeding," by Henry and Morrison, 1922, page 86, Section 126:

"Body fat from food fat. Many experiments have conclusively shown that the fat in food which has been acted on by the digestive fluids in the intestines, may be directly stored in the body tissues when supplied in large quantity.

"Hoffmann allowed a dog to starve until its weight had decreased from 26.5 to 16 kilograms and the supply of fat in its body had practically disappeared, as shown by the increased decomposition of the protein tissues at that time. For five days this dog was fed large quantities of fat and only a little fat-free meat, during which time it gained 4.2 kgms. in weight. When slaughtered its body contained 1,353 grams of fat, only 131 of which could possibly have come from the protein fed. Hence much of the fat formed during this time must have come from the fat of the food.

"Henriques and Hansen fed two three-months-old pigs barley meal together with oil. The first pig received linseed and the second cocoanut oil. Samples of the body fat were removed from the back of each pig through incisions, and analyzed. The fat which had formed during the feeding resembled in odor, consistency, and composition the vegetable fat which had been fed. Later, when the feeds were reversed the body fat then formed showed a corresponding change in properties.

"All the digested fat taken into the body of the animal beyond that required for maintenance cannot, however, be deposited as body fat, since considerable losses always occur through the energy expended in digestion and metabolism.

"The amount of body fat which can be formed by farm animals from 100 lbs. of digestible fat in the food consumed varies from 64.4 lbs. in the case of pure fats to 47.4 lbs. in the fats of roughages."

"Chemistry of Food and Nutrition," by Sherman of Columbia University, also shows that the views set forward by Dr. Wiley are old, and that it is now recognized that fat maybe stored directly.

It is, of course, recognized by all the investigators that fat can be made from carbohydrates. In fact, most of the herbivorous animals obtain their fat in this manner.

It should be noted that the body fat of the Eskimo contains fats of greater unsaturatedness than that normal to the great mass of people living in the temperate zone. Also it is true that the fats of the Polynesians contain fatty acids of the cocoanut oil series, which are not normal to the great mass of people receiving a more varied diet. In the case of the Eskimo, this seems, undoubtedly, to be due to the fact that their body is influenced by the blubber fats consumed, and in the case of the Polynesians, by the cocoanut oils which enter largely into their diet.

H. J. MORRISON,
April 10, 1926.

The Uehling Instrument Company, of Paterson, N. J., announces the appointment of W. B. McBurney, 619 Trust Company of Georgia Building, Atlanta, Ga., as representative for Georgia and eastern Tennessee.

TITLES OF ABSTRACTS FROM OTHER JOURNALS

CHEMICAL ABSTRACTS 20, 1 TO 5.

Iodine-bromine number via L. W. Winkler. K. Scheffler.

Modern processes for refining oil. E. Weiss.

Some analytical data on the oils from sharks and rays. Allen Rogers.

Detection of coconut and palm kernel oils in cacao butter and fat from milk chocolate. W. F. Baughman.

Method for the rapid and accurate determination of fat in cacao products. H. A. Lepper and H. C. Waterman.

Waxes. A new chemical index. R. Rosseau.

Colored goods and the Laundry. Geo. W. Johnson.

Refining Vegetable Oils. C. H. Hapgood and G. F. Mayno. U. S. 1,560,084, Nov. 3. See Brit. 228,889 (C. A. 19, 3028).

Soap. A. Welter. U. S. 1,560,626, Nov. 10. Fatty acid soap stock or other fatty acids are mixed at a temperature approximately their m.p., with water free alkalai carbonate such as Na_2CO_3 in double the quantity required for the complete saponification of the fatty acids so that the excess carbonate is sufficient to absorb the CO_2 resulting from the saponification and produce a soap containing no stronger alkali than $NaHCO_3$.

Shaving Soap. C. A. Sipe. U. S. 1,558,642, Oct. 27. The reaction products of "lye," fat and H_3BO_3 are mixed with smaller quantities of acetanilide and H_2O_2.

Glycerol Soap. W. T. Gussinklo. U. S. 1,550,540, Aug. 18. A hard soap is formed from coconut oil, NaOH soln. and glycerol, the glycerol constituting at least 75 per cent of the volume.

Detergent mixture. E. M. Heckman. U. S. 1,559,960, Nov. 3. A compound adapted for cleaning terra cotta walls, etc., comprises soap and blast furnace slag which has been granulated by introducing it into H_2O while hot.

Porous Soap-tablets containing bran, oatmeal, linseed meal, sawdust or other absorbent material. C. J. Atkinson. U. S. 1,556,576, Oct. 13.

Composition for cleaning grease or paint from fabrics. C. Ellis. U. S. 1,557,520, Oct. 13. A mixt. of C_2HCl_3 80-75 and EtOAc 15-20 per cent, substantially free from fats, soaps and waxes.

Oxidative splitting of unsaturated acids. A. Grun and F. Wittka.

A new catalyzer apparatus. Anonymous.

Reaction capacity of iodine toward fats. VI. *Solution of iodine in glacial acetic acid.* B. M. Margosches, L. Friedmann and E .Neufeld.

Affinity of iodine for Ethylene Compounds (in different solvents). Simple and rapid method for the determination of acety number. Emile Andre.

Bromine-acetic acid reagent for determining the iodine-bromine value. L. W. Winkler.

The usefulness of the Iodine number determined according to Margosches in the examination of Oils. Erich Stock.

The preparation and properties of sulfonated fish oil and neats-foot Oil. E. Stiasny and C. Riess.

Observations on coconut and palm-kernel oil. "Leim" fats. K. L. Weber.

Oxygen-containing washing compounds and their keeping quality. W. Schaefer.

The Chemical Constitution of the Compounds of Sulfuric Acid with the higher unsaturated aliphatic acids. H. Pomeranz.

Theory and practice of the manufacture of soap bases. Bergell-Laskaray.

Standardization of the analysis of sulforcinates. Henriette Galibern and Henry Sunder.

Intersterification of glycerides and their technical applications. A Grun.

The glycerides of hardened whale oil. G. Greitemann.

Partial saponification of mixed glycerides. K. H. Bauer.

Pressing or extracting. E. W. Albrecht.

Hardened fats and leathering ability of curd soaps. R. G. Seifensieder Ztg. 52,851-2 (1925).

Mixed Glycerides of lower and higher fatty acids. G. L. Schwartz.

Removing free sulfur from grease. H. Christison and C. L. Nutting.

Extracting Oils from Blubber. K. Holter and S. Thune. Brit. 232,954, April

22, 1924. See Norw. 40,903 (C. A. 19, 1504).

Annual review in the field of fats, oils and waxes for 1923. W. Herbig.

The application of the rapid iodine number method to fish oils. B. M. Margosches, L. Friedmann and K. Fuchs.

Method of separating saponifiable fats and oils from unsaponifiable mineral oils. C. Stiepel.

Determination of unsaponifiable matter in distillate fats. J. Grosser.

Deodorization of fish oils and similar fats. J. Grosser.

Characteristics of fish and allied oils. A. R. Lange.

Tall oil. Duesberg.

The determination of the acid and lime stability of sulfonated oils. W. Herbig and H. Seyferth.

Continuous press for the treatment of oil seeds. Andre Dupire.

Factors influencing variations in the physical and chemical constants of a given fat. S. Wolff.

Palm oil in French West Africa. Paul Ammann.

Determination of oil in peanut oil cake. G. Bredon and A. Dubois..

Autoclave-saponification and autoclaving methods. C. Stiepel.

Fundamental principles of detergent action revealed by the graphite test. R. M. Chapin.

Detergents and soaps. E. A. F.

Analyse der Fette und Wachse. Bandl-Methoden. A. Grun. Berlin. Julius Springer. 575 pp. Price bound G. M. 36. Reveiwed in Ind. Eng. Chem. 17, 1297 (1925).

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Mixing wool waste and grease. F. C. Fantz and E. G. Rathbone.

Catalytic nickel. M. Raney.

Colloidal reactions in the oil and fat industry. J. Leimdorfer.

Oxidation and polymerization of vegetable oils and their fatty acids. G. S. Petrov and A. I. Danilovich.

The Free Acidity of Edible Oils. Antonio Ceriotti and Alfredo Sanguinetti.

A Survey of equipment used in modern soap manufacture. IV. C. Richter.

The determination of the turbidity point of soap solutions. K. Braun.

A new method of determination of rosin in soap. G. de Belsunce.

Saponification under pressure. A. Welter.

Gloss and smoothness in milled toilet soaps. J. Lieblein.

Rancidity and spot formation in toilet soaps. C. Bergell.

New fields of application for trichlorethylene. R. Deckert.

Refining fatty oils. Henrik Bull.

Manufacture of emulsions of marine oils. Svaneapotheket, Bergen.

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Boiler for liver-oil manufacture. Otto Halsey.

Wax mixture for treating thread. J. Fry.

Chromium Soap. T. T. Gray.

Apparatus for Purifying used soap solutions in laundries, etc. J. E. Caps.

Washing Powder. A. Lindahl.

Washing Powder. Happachs Industri A.-B.

The adoption of uniform testing methods for the fatty oil industry. Anon.

Dugong oil from Australia. Anon.

Highly unsaturated acids in ox-liver oil. Kanesuke Kimura.

The mistake in the acid value of crude oils and fats, and the use of the impure acid value. Tei Hidaka.

The separation of ricinoleic acid from the mixed fatty acids of castor oil. Kinjiro Inokuchi.

Studies on catalytic hydrogenation of highly unsaturated acids. I. The course of hydrogenation of methyl esters of highly unsaturated acids in the presence of nickel catalyst. Yoshiyuki Toyama and Tomotaro Tsuchiya.

The formation of the iso-unsaturated solid acids during the hydrogenation of fatty oils. I. Presence of iso-acids in hardened sardine oil. Sei-ichi Ueno.

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